DSC/Circ.2
11 March 1996

Ref: T3/2.01

DRAFT AMENDMENTS TO THE CODE OF SAFE PRACTICE FOR SOLID BULK CARGOES (BC CODE)

New entry for Coal in Appendix to the BC Code

1 The Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC), at its first session, considered the draft amendments to the BC Code - New entry for Coal in Appendix B (DSC 1/7 and DSC 1/7/Add.1), prepared by the Working Group established by the Sub-Committee on Containers and Cargoes (BC) at its thirty-fourth session (27 to 31 March 1995) and agreed to the draft amendments to the Code as amended and set out in the annex to this circular, for approval by the Maritime Safety Committee at its sixty-sixth session.

2 Considering the importance of providing Administrations and other parties concerned with the information on the draft new entry for coal introducing a method of gas analysis of coal cargoes for detection of methane emission and/or self-heating as soon as possible for the safe carriage of coal cargoes, the Sub-Committee agreed to disseminate the draft amendments to the BC Code before they are considered by MSC 66.

3 Member Governments are invited to bring this circular to the attention of shipowners, ship operators, seafarers, shippers, terminal operators and other parties concerned.

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ANNEX

DRAFT AMENDMENTS TO THE CODE OF SAFE PRACTICE FOR SOLID BULK CARGOES (BC CODE)

COAL

Amend the entry in Appendix B for COAL as follows:

"COAL*

BC no.	IMO class	MFAG table no.	Approximate stowage factor m^3/t	EmS no.
010	MHB	311, 616**	0.79 to 1.53	B14

Properties and characteristics

1 Coals may emit methane, a flammable gas. A methane/air mixture containing between 5 % and 16 % methane constitutes an explosive atmosphere which can be ignited by sparks or naked flame, e.g. electrical or frictional sparks, a match or lighted cigarette. Methane is lighter than air and may, therefore, accumulate in the upper region of the cargo space or other enclosed spaces. If the cargo space boundaries are not tight, methane can seep through into spaces adjacent to the cargo space.

2 Coals may be subject to oxidation leading to depletion of oxygen and an increase in carbon dioxide in the cargo space (see also section 3 and appendix F).

3 Some coals may be liable to self-heating that could lead to spontaneous combustion in the cargo space. Flammable and toxic gases, including carbon monoxide, may be produced. Carbon monoxide is an odourless gas, slightly lighter than air, and has flammable limits in air of 12 % to 75 % by volume. It is toxic by inhalation with an affinity for blood haemoglobin over 200 times that of oxygen.

4 Some coals may be liable to react with water and produce acids which may cause corrosion. Flammable and toxic gases; including hydrogen, may be produced. Hydrogen is an odourless gas, much lighter than air, and has flammable limits in air of 4 % to 75 % by volume.

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* For comprehensive information on transport of any material listed, refer to sections 1-10 of this Code.

** Refer to paragraph 6.1.1 (Asphyxia) of the MFAG.

Segregation and stowage requirements

1 Boundaries of cargo spaces where materials are carried should be resistant to fire and liquids.

2 Coals should be "separated from" goods of classes 1 except (division 1.4), 2, 3, 4, and 5 in packaged form (see IMDG Code) and "separated from" solid bulk materials of classes 4 and 5.1.

3 Stowage of goods of class 5.1 in packaged form or solid bulk materials of class 5.1 above or below a coal cargo should be prohibited.

4 Coals should be "separated longitudinally by an intervening complete compartment or hold from"[1] goods of class 1 other than division 1.4.

General requirements for all coals

1 Prior to loading, the shipper or his appointed agent should provide in writing to the master the characteristics of the cargo and the recommended safe handling procedures for loading and transport of the cargo. As a minimum, the cargo's contract specifications for moisture content, sulphur content and size should be stated and especially whether the cargo may be liable to emit methane or self-heat.

2 The master should be satisfied that he has received such information prior to accepting the cargo. If the shipper has advised that the cargo is liable to emit methane or self-heat, the master should additionally refer to the "Special precautions".

3 Before and during loading, and while the material remains on board, the master should observe the following:

.1 All cargo spaces and bilge wells should be clean and dry. Any residue of waste material or previous cargo should be removed, including removable cargo battens, before loading.

.2 All electrical cables and components situated in cargo spaces and adjacent spaces should be free from defects. Such cables and electrical components should be safe for use in an explosive atmosphere or positively isolated.

.3 The ship should be suitably fitted and carry on board appropriate instruments for measuring the following without requiring entry into the cargo space:

.1 concentration of methane in the atmosphere;

.2 concentration of oxygen in the atmosphere;

.3 concentration of carbon monoxide in the atmosphere;

.4 pH value of cargo hold bilge samples.

[1]For the interpretation of the segregation terms see paragraph 9.3.3 of the Code.

These instruments should be regularly serviced and calibrated. Ship personnel should be trained in the use of such instruments. Details of gas measurement procedures are given in appendix G.

.4 It is recommended that means be provided for measuring the temperature of the cargo in the range 0-100ºC. Such arrangements should enable the temperature of the coal to be measured while being loaded and during the voyage without requiring entry into the cargo space

.5 The ship should carry on board the self-contained breathing apparatus required by SOLAS regulation II-2/17. The self-contained breathing apparatus should be worn only by personnel trained in its use (see also section 3 and appendix F).

.6 Smoking and the use of naked flames should not be permitted in the cargo areas and adjacent spaces and appropriate warning notices should be posted in conspicuous places. Burning, cutting, chipping, welding or other sources of ignition should not be permitted in the vicinity of cargo spaces or in other adjacent spaces, unless the space has been properly ventilated and the methane gas measurements indicate it is safe to do so.

.7 The master should ensure that the coal cargo is not stowed adjacent to hot areas.

.8 Prior to departure the master should be satisfied that the surface of the material has been trimmed reasonably level to the boundaries of the cargo space to avoid the formation of gas pockets and to prevent air from permeating the body of the coal. Casings leading into the cargo space should be adequately sealed, the shipper should ensure that the master receives the necessary co-operation from the loading terminal (see also section 5).

.9 The atmosphere in the space above the cargo in each cargo space should be regularly monitored for the presence of methane, oxygen and carbon monoxide. Details of gas monitoring procedures are given in appendix G. Records of these readings should be maintained. The frequency of the testing should depend upon the information provided by the shipper and the information obtained through the analysis of the atmosphere in the cargo space.

.10 Unless expressly directed otherwise, all holds should be surface ventilated for the first 24 hours after departure from the loading port. During this period, one measurement should be taken from one sample point per hold.

If after 24 hours the methane concentrations are at an acceptably low level, the ventilators should be closed. If not, they should remain open until acceptably low levels are obtained. In either event measurements should be continued on a daily basis.

If significant concentrations of methane subsequently occur in unventilated holds the appropriate special precautions as described in section 2.2.1 should apply.

.11 The master should ensure as far as possible that any gases which may be emitted from the materials do not accumulate in adjacent enclosed spaces.

.12 The master should ensure that enclosed working spaces, e.g. storerooms, carpenter's shop, passage ways, tunnels, etc., are regularly monitored for the presence of methane, oxygen and carbon monoxide. Such spaces should be adequately ventilated.

.13 Regular hold bilge testing should be systematically carried out. If the pH monitoring indicates that a corrosion risk exists, the master should ensure that all bilges are kept dry during the voyage in order to avoid possible accumulation of acids on tank tops and in the bilge system.

.14 If the behaviour of the cargo during the voyage differs from that specified in the cargo declaration, the master should report such differences to the shipper. Such reports will enable the shipper to maintain records on the behaviour of the coal cargoes, so that the information provided to the master can be reviewed in the light of transport experience.

.15 The Administration may approve alternative requirements to those recommended in this schedule.

Special precautions

1 Coals emitting methane

If the shipper has advised that the cargo is liable to emit methane or analysis of the atmosphere in the cargo space indicates the presence of methane in excess of 20% of the lower explosive limit (LEL), the following additional precautions should be taken:

.1 Adequate surface ventilation should be maintained. On no account should air be directed into the body of the coal as air could promote self-heating.

.2 Care should be taken to vent any accumulated gases prior to removal of the hatch covers or other openings for any reason, including unloading. Cargo hatches and other openings should be opened carefully to avoid creating sparks. Smoking and the use of naked flame should be prohibited.

.3 Personnel should not be permitted to enter the cargo space or enclosed adjacent spaces unless the space has been ventilated and the atmosphere tested and found to be gas-free and to have sufficient oxygen to support life. If this is not possible, emergency entry into the space should be undertaken only by trained personnel wearing self-contained breathing apparatus, under the supervision of a responsible officer. In addition, special precautions to ensure that no source of ignition is carried into the space should be observed (see also section 3 and appendix F).

.4 The master should ensure that enclosed working spaces, e.g. storerooms, carpenter's shops, passage ways, tunnels, etc., are regularly monitored for the presence of methane. Such spaces should be adequately ventilated and, in the case of mechanical ventilation, only equipment safe for use in an explosive atmosphere should be used. Testing is especially important prior to permitting personnel to enter such spaces or energizing equipment within those spaces.

2 Self-heating coals

.1 If the shipper has advised that the cargo is liable to self-heat, the master should seek confirmation that the precautions intended to be taken and the procedures intended for monitoring the cargo during the voyage are adequate.

.2 If the cargo is liable to self-heat or analysis of the atmosphere in the cargo space indicates an increasing concentration of carbon monoxide, then the following additional precautions should be taken:

.2.1 The hatches should be closed immediately after completion of loading in each cargo space. The hatch covers can also be additionally sealed with a suitable sealing tape. Surface ventilation should be limited to the absolute minimum time necessary to remove methane which may have accumulated. Forced ventilation should not be used. On no account should air be directed into the body of the coal as air could promote self-heating.

.2.2 Personnel should not be allowed to enter the cargo space, unless they are wearing self-contained breathing apparatus and access is critical to the safety of the ship or safety of life. The self-contained breathing apparatus should be worn only by personnel trained in its use (see also section 3 and appendix F).

.2.3 When required by the competent authority, the carbon monoxide concentration in each cargo space should be measured at regular time intervals to detect self-heating.

.2.4 If at the time of loading, when the hatches are open, the temperature of the coal exceeds 55°C, expert advice should be obtained.

.2.5 If the carbon monoxide level is increasing steadily, a potential self-heating may be developing. The cargo space should be completely closed down and all ventilation ceased. The master should seek expert advice immediately. Water should not be used for cooling the material or fighting coal cargo fires at sea, but may be used for cooling the boundaries of the cargo space.

.2.6 **Information to be passed to owners**

The most comprehensive record of measurements will always be the log used to record daily results. The coal cargo monitoring log for the voyage should be faxed, or the appropriate content should be telexed to the vessel's owners.

The following minimum information is essential if an accurate assessment of the situation is to be achieved:

(a) identity of the holds involved; monitoring results covering carbon monoxide, methane and oxygen concentrations;

(b) if available, temperature of coal, location and method used to obtain results;

(c) time gas samples taken (monitoring routine);

(d) time ventilators opened/closed;

(e) quantity of coal in hold(s) involved;

(f) type of coal as per shipper's declaration, and any special precautions indicated on declaration;

(g) date loaded, and ETA at intended discharge port (which should be specified);

(h) comments or observations from the ship's Master."

Add the following new Appendix G:

"**APPENDIX G**

Procedures for gas monitoring of coal cargoes

G.1 Observations

Carbon monoxide monitoring, when conducted in accordance with the following recommendations, will provide a reliable early indication of self-heating within a coal cargo. This allows preventive action to be considered without delay. A steady rise in the level of carbon monoxide detected within a hold is a conclusive indication that self-heating is taking place.

All vessels engaged in the carriage of coal should carry on board an instrument for measuring methane, oxygen and carbon monoxide gas concentrations (general requirements for all coals, section 3.3 in the coal entry, appendix B), so that the atmosphere within the cargo space may be monitored. This instrument should be regularly serviced and calibrated in accordance with the manufacturer's instructions. When properly maintained and operated, this instrument will provide reliable data about the atmosphere within the cargo space. Care needs to be exercised in interpreting methane measurements carried out in the low oxygen concentrations often found in unventilated cargo holds. The catalytic sensors normally used for the detection of methane rely on the presence of sufficient oxygen for accurate measurement. This phenomenon does not affect the measurement of carbon monoxide, or measurement of methane by infrared sensor. Further guidance may be obtained from the instrument manufacturer.

G.2 Sampling and measurement procedure

G.2.1 Equipment

An instrument is required which is capable of measuring methane, oxygen and carbon monoxide concentrations. The instrument should be fitted with an aspirator, flexible connection and a length of tubing to enable a representative sample to be obtained from within the square of the hatch. Stainless steel tubing approximately 0.5 m in length and 6 mm nominal internal diameter with an integral stainless steel threaded collar is preferred. The collar is necessary to provide an adequate seal at the sampling point..

A suitable filter should be used to protect the instrument against the ingress of moisture as recommended by the manufacturer. The presence of even small amount of moisture will compromise the accuracy of the measurement.

G.2.2 Siting of sampling points

In order to obtain meaningful information about the behaviour of coal in a hold, gas measurements should be made via one sample point per hold. To ensure flexibility of measurement in adverse weather, however, two sample points should be provided per hold, one on the port side and one on the starboard side of the hatch cover (refer to figure G.2.7). Measurement from either of these locations is satisfactory.

Each sample point should comprise a hole of diameter approximately 12 mm positioned as near to the top of the hatch coaming as possible. It should be sealed with a screw cap to prevent ingress of water and air. It is essential that this cap is securely replaced after each measurement to maintain a tight seal.

The provision of any sample point should not compromise the seaworthiness of the vessel.

G.2.3 Measurement

Ensure that the instrument is calibrated and working properly in accordance with the manufacturer's instructions. Remove the sealing cap, insert the stainless steel tube into sampling point and tighten the integral cap to ensure an adequate seal. Connect the instrument to the sampling tube. Draw a sample of the hold atmosphere through the tube using the aspirator until steady readings are obtained. Log the results on a form which records cargo hold, date and time for each measurement.

G.2.4 Measurement strategy

The identification of incipient self-heating from measurement of gas concentrations is more readily achieved under unventilated conditions. This is not always desirable because of the possibility of the accumulation of methane to dangerous concentrations. This is primarily, but not exclusively, a problem in the early stages of a voyage. Therefore it is recommended that holds are initially ventilated until measured methane concentrations are at an acceptably low level.

G.2.5 Measurement in unventilated holds

Under normal conditions one measurement per day is sufficient as a precautionary measure. However, if carbon monoxide levels are higher than 30 ppm then the frequency should be increased to at least twice a day at suitably spaced intervals. Any additional results should be logged.

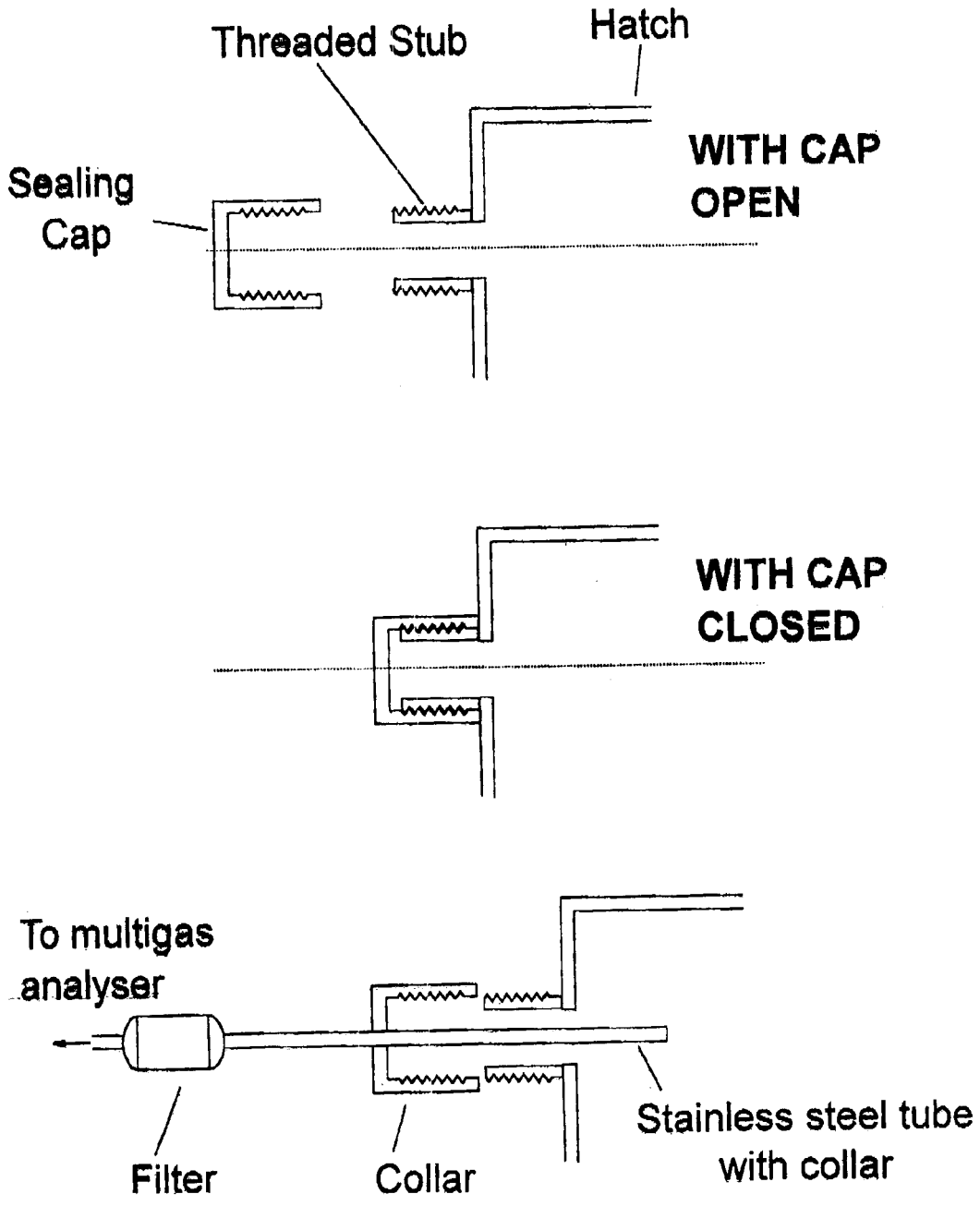
If the carbon monoxide level in any hold reaches 50 ppm a self-heating condition may be developing and the owners of the vessel should be notified.

G.2.6 Measurement in ventilated holds

If the presence of methane is such that the ventilators are required to remain open, then a different procedure should be applied to enable the onset of any incipient self-heating to be detected.

To obtain meaningful data the ventilators should be closed for a period before the measurements are taken. This period may be chosen to suit the operational requirements of the vessel, but it is recommended that it is not less than four hours. It is vital in the interests of data interpretation that the shutdown time is constant whichever time period is selected. These measurements should be taken on a daily basis. If the carbon monoxide results exhibit a steady rise over three consecutive days, or exceed 50 ppm on any day, the owners of the vessel should be notified.

FIGURE G.2.7
DIAGRAM OF GAS SAMPLING POINT"


Threaded Stub
Hatch
WITH CAP
OPEN
Sealing
Cap
WITH CAP
CLOSED
To multigas
analyser
Filter
Collar
Stainless steel tube
with collar